

XD series

Proportional, industrial hand grip controllers •
non-contacting Hall effect technology



DISTINCTIVE FEATURES

- SIL 2 compatible - Redundant Hall sensors
- Resists high axial load (1780 N - 400 lbf)
- Shallow mounting depth of <60 mm (2.36)
- Rated for 10 million lifecycles
- SAE CAN bus J1939-71



ENVIRONMENTAL SPECIFICATIONS

- Operating Temperature: -40 °C to +85 °C (-40 °F to +185 °F)
- Storage Temperature: -40 °C to +85 °C (-40 °F to +185 °F)
- Above Panel Sealing: Up to IP67 (subject to handle configuration)
- Humidity: IEC 60068-2-38
- Thermal shock: SAE J1455 section 4.1.3.2
- Salt spray: IEC 60068-2-11
- Random vibration: IEC 60068-2-64
- Sinusoidal vibration: IEC 60068-2-6
- EMC Emissions:
 - Radiated Emissions Level: ECE/324/Add.9:2012; CISPR 25:2002
 - Radiated Emissions Level: CISPR 25:2008
- EMC Immunity:
 - ESD: ISC 10605:2008; criteria A
 - Radiated immunity: ISO 11452-2:2004; criteria B
 - Bulk current injection immunity: ISO 11452-4:201; criteria A
 - Pulse 1, Pulse 2a, Pulse 2b, Pulse 3a, Pulse 3b, Pulse 4, Pulse 5a: ISO 7637-2:2011; criteria A



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The company reserves the right to change specifications without notice.



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ELECTRICAL SPECIFICATIONS

- Technology: Redundant Hall effect sensor
- Supply voltage range: 7 - 35 VDC
- Typical current consumption: 12 V @ 53 mA
- Transient overvoltage max: 40 V
- Reverse polarity Max: -1000 VDC
- Output signal: SAE CANbus J1939-71
- Connections: Deutsch DTM04-6p



ELECTRICAL CONNECTIONS

- Six position connector: Deutsch DTM04-6P
- Wire: 22 AWG, PTFE insulation with expandable sleeve
- Length: 6:00" +/- 0.5" (bottom of joystick to connector)



MECHANICAL SPECIFICATIONS

- Operation: Two axis
- Deflection angle in X & Y directions:
 - ±20° for square limiter plate (standard)
 - ±16° for round limiter plate
- Operating torque, breakout: 1.28Nm*
- Operating torque, 50% travel: 1.93Nm*
- Operating torque, 100% travel: 3.21Nm*
- Maximum axial load: 400 lbf.
- Expected life: 10 million lifecycles (X and Y axis)
- Lever Action (centering): Spring return



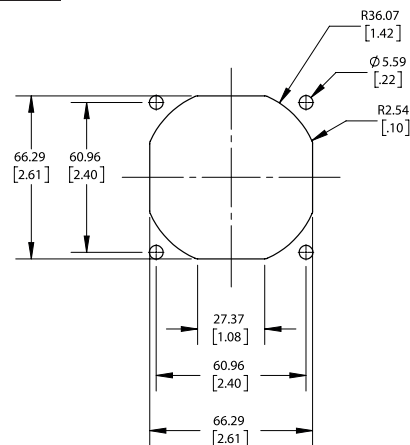
MATERIALS

- Shaft: Stainless steel
- Boot: Silicone
- Handles: Glass filled nylon
- Bezel: Hard black anodized aluminum
- Body: Aluminum
- Cover: Zinc plated steel
- Weight: 800 g

*Considering most common options selected:
 - Option M (1.24Nm)
 - Option G (with guided feel)



PANEL CUT-OUT



CAN J1939 INTERFACE SPECIFICATION

The XD Series utilizes redundant Hall effect sensors to measure the primary X and Y axis. The CAN controller support various button configurations as well as proportional thumbwheels and mini-joysticks for additional axis data.

All axis and button data are delivered on a CAN 2.0B compliant physical interface. Two additional signals allow configuration of the controller Source Address. Controller messages are delivered per the SAE J1939-71 message protocol.

CAN 2.0B INTERFACE PARAMETERS

- Baud rate: 250 Kbps
- Transmission repetition rate: 50 ms to 80 ms **
- BJMI/EJMI interval time: 20 ms
- Terminating resistor: No
(available by special request to factory)
- Connection to Deutsch DTM04-6P connector:

| Pin | Color | Function |
|-----|--------|----------------------|
| 1 | White | CAN Lo |
| 2 | Green | CAN Hi |
| 3 | Blue | Source Address SEL 1 |
| 4 | Orange | Source Address SEL 0 |
| 5 | Black | Ground |
| 6 | Red | 6 - 35 VDC |

** Transmission repetition rate is dependent upon the faceplate configuration.



CAN J1939 INTERFACE SPECIFICATION (CONTINUED)

CAN MESSAGE PROTOCOL

- Primary Axis and button data on Basic Joystick Message 1 (BJM1):
 - Priority: 3
 - Base PGN: 0xFDD6
 - Source address: 0x10¹
 - Data field: 8 bytes
- Redundant Axis data on Extended Joystick Message 1 (EJM1):
 - Priority: 3
 - Base PGN: 0xFDD7
 - Source address: 0x10¹
 - Data field: 8 bytes
- Additional thumbwheels and mini-joysticks data on Extended Joystick Message 2 (EJM2):
 - Priority: 3
 - Base PGN: 0xFDD9
 - Source address: 0x10¹
 - Data field : 8 bytes

Note 1: Alternate source addresses can be configured by grounding of the blue and/or orange wires.

- Source address= 0x10: ORANGE= floating , BLUE= floating (default)
- Source address= 0x20: ORANGE= floating, BLUE= grounded
- Source address= 0x30: ORANGE= grounded, BLUE= floating
- Source address= 0x40: ORANGE= grounded, BLUE= grounded

BJM1 DATA FIELD STRUCTURE:

| START POSITION (BYTE/BIT) | LENGTH (BITS) | FUNCTION |
|------------------------------|------------------|----------------------------------------|
| 1/1 | 2 | Primary X-axis neutral position status |
| 1/3 | 2 | Primary X-axis left position status |
| 1/5 | 2 | Primary X-axis right position status |
| 1/7 to 2/8 | 10 | Primary X-axis position data |
| 3/1 | 2 | Primary Y-axis neutral position status |
| 3/3 | 2 | Primary Y-axis down position status |
| 3/5 | 2 | Primary Y-axis up position status |
| 3/7 to 4/8 | 10 | Primary Y-axis position data |
| 6/1 | 2 | Button 4 status |
| 6/3 | 2 | Button 3 status |
| 6/5 | 2 | Button 2 status |
| 6/7 | 2 | Button 1 status |
| 7/1 | 2 | Button 8 status |
| 7/3 | 2 | Button 7 status |
| 7/5 | 2 | Button 6 status |
| 7/7 | 2 | Button 5 status |
| 8/5 | 2 | Button 10 status |
| 8/7 | 2 | Button 9 status |

EJM1 DATA FIELD STRUCTURE:

| START POSITION (BYTE/BIT) | LENGTH (BITS) | FUNCTION |
|------------------------------|------------------|------------------------------------------|
| 1/1 | 2 | Redundant X-axis neutral position status |
| 1/3 | 2 | Redundant X-axis left position status |
| 1/5 | 2 | Redundant X-axis right position status |
| 1/7 to 2/8 | 10 | Redundant X-axis position data |
| 3/1 | 2 | Redundant Y-axis neutral position status |
| 3/3 | 2 | Redundant Y-axis down position status |
| 3/5 | 2 | Redundant Y-axis up position status |
| 3/7 to 4/8 | 10 | Redundant Y-axis position data |

EJM2 DATA FIELD STRUCTURE:

| START POSITION (BYTE/BIT) | LENGTH (BITS) | FUNCTION |
|------------------------------|------------------|--------------------------------|
| 1/1 | 2 | A-axis neutral position status |
| 1/3 | 2 | A-axis left position status |
| 1/5 | 2 | A-axis right position status |
| 1/7 to 2/8 | 10 | A-axis position data |
| 3/1 | 2 | B-axis neutral position status |
| 3/3 | 2 | B-axis left position status |
| 3/5 | 2 | B-axis right position status |
| 3/7 to 4/8 | 10 | B-axis position data |
| 5/1 | 2 | C-axis neutral position status |
| 5/3 | 2 | C-axis left position status |
| 5/5 | 2 | C-axis right position status |
| 5/7 to 6/8 | 10 | C-axis position data |

Note: If faceplate configured with n buttons, Trigger and/or paddle would be respectively positioned in Button n+1 and Button n+2.



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CANOPEN INTERFACE SPECIFICATION

CANOPEN INTERFACE PARAMETERS

- Baud rate: 250 kbits/s
- Node ID: 20h
- Buttons: 1A0h (180h + Node ID)
- Analog (axis) outputs: 2A0h (280h + Node ID)
- Heartbeat (500ms): 720h (700h + Node ID)
- Axis resolution: 8-bit
- Network Management: Auto start enabled

BUTTON OUTPUT CONFIGURATION

Button status is transmitted in the 8-byte data field of frames with an identifier of 1A0 (default).

| IDENTIFIER | BYTE 0 | BYTE 1 | BYTE 2 | BYTE 3 | BYTE 4 | BYTE 5 | BYTE 6 | BYTE 7 |
|------------|---------------|----------------|--------|--------|--------|--------|--------|--------|
| 1A0 | Buttons (7:0) | Buttons (15:8) | - | - | - | - | - | - |

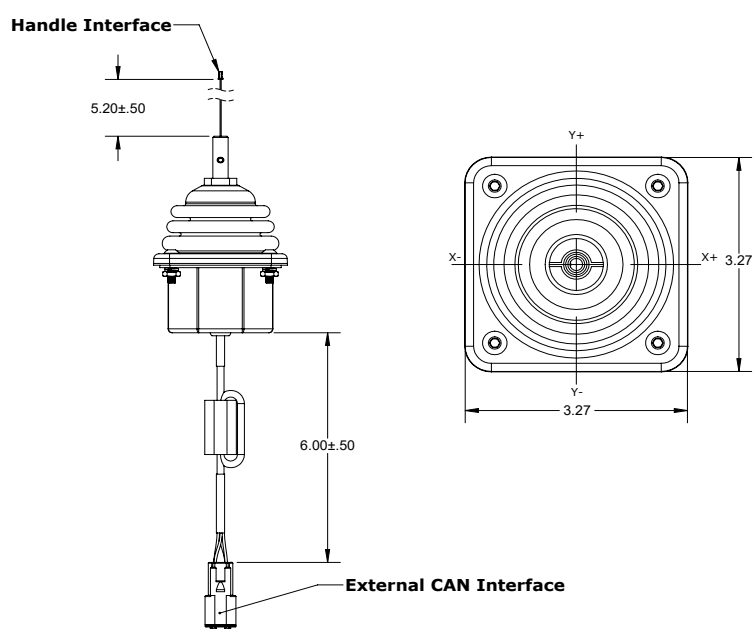
ANALOG OUTPUT CONFIGURATION

8-bit analog data is transmitted in the 8-byte data field of frames with an identifier of 2A0 (default).

| IDENTIFIER | BYTE 0 | BYTE 1 | BYTE 2 | BYTE 3 | BYTE 4 | BYTE 5 | BYTE 6 | BYTE 7 |
|------------|------------|------------|------------|------------|------------|------------|--------|--------|
| 2A0 | A_IN0(7:0) | A_IN1(7:0) | A_IN2(7:0) | A_IN3(7:0) | A_IN4(7:0) | A_IN5(7:0) | - | - |

ELECTRICAL INTERFACE AND CONNECTIONS

DIMENSIONS

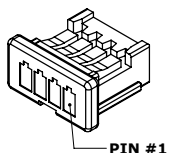


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HANDLE INTERFACE



SERIAL LINK MOLEX 5013300400
CONNECTOR PIN# DESIGNATION

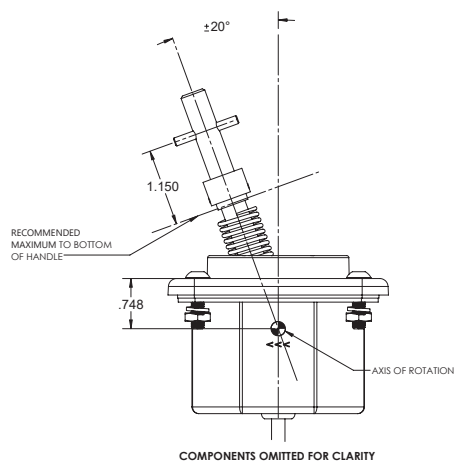
IF UART interface:
19200 baud, no parity, 8 bit,
1 stop bit, no hardware flow
control

| PIN # | FUNCTION |
|-------|------------|
| 1 | Vcc (+5 V) |
| 2 | Rx |
| 3 | Tx |
| 4 | Ground |

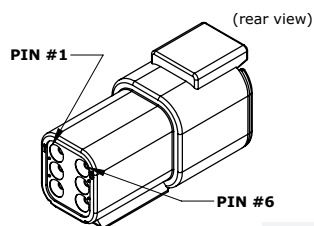
IF CAN interface:

| PIN # | FUNCTION |
|-------|------------|
| 1 | Vcc (+5 V) |
| 2 | Rx |
| 3 | Tx |
| 4 | Ground |

MECHANICAL INTERFACE AND DIMENSIONS

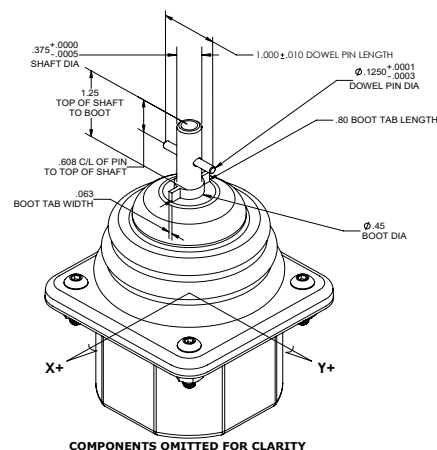


EXTERNAL CAN



DEUTSCH DTM04-6P
CONNECTOR PIN# DESIGNATION

| PIN # | FUNCTION |
|-------|----------|
| 1 | CAN-LO |
| 2 | CAN-HI |
| 3 | SEL 1 |
| 4 | SEL 2 |
| 5 | Ground |
| 6 | Vin |

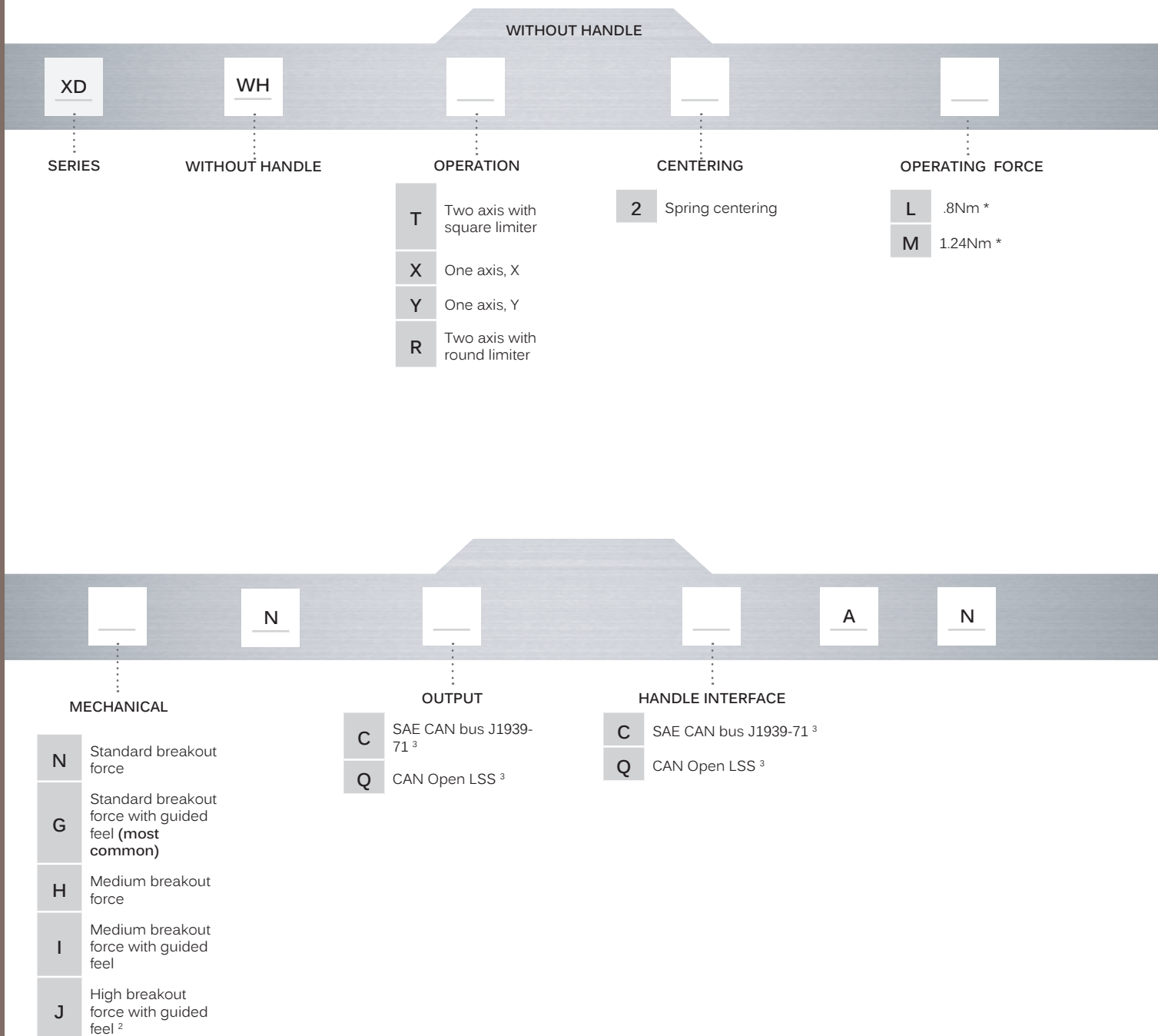


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BUILD YOUR PART NUMBER



Notes:

The Guided feel option aids the joystick lever into the cardinal direction
Guided feel option is recommended for «Operating force Option M»

¹ Measured at ±10° (50% travel) from center (without guided feel.)

² High breakout force can only come with round limiter plate.

³ Option selected for HANDLE INTERFACE must be the same as OUTPUT option.



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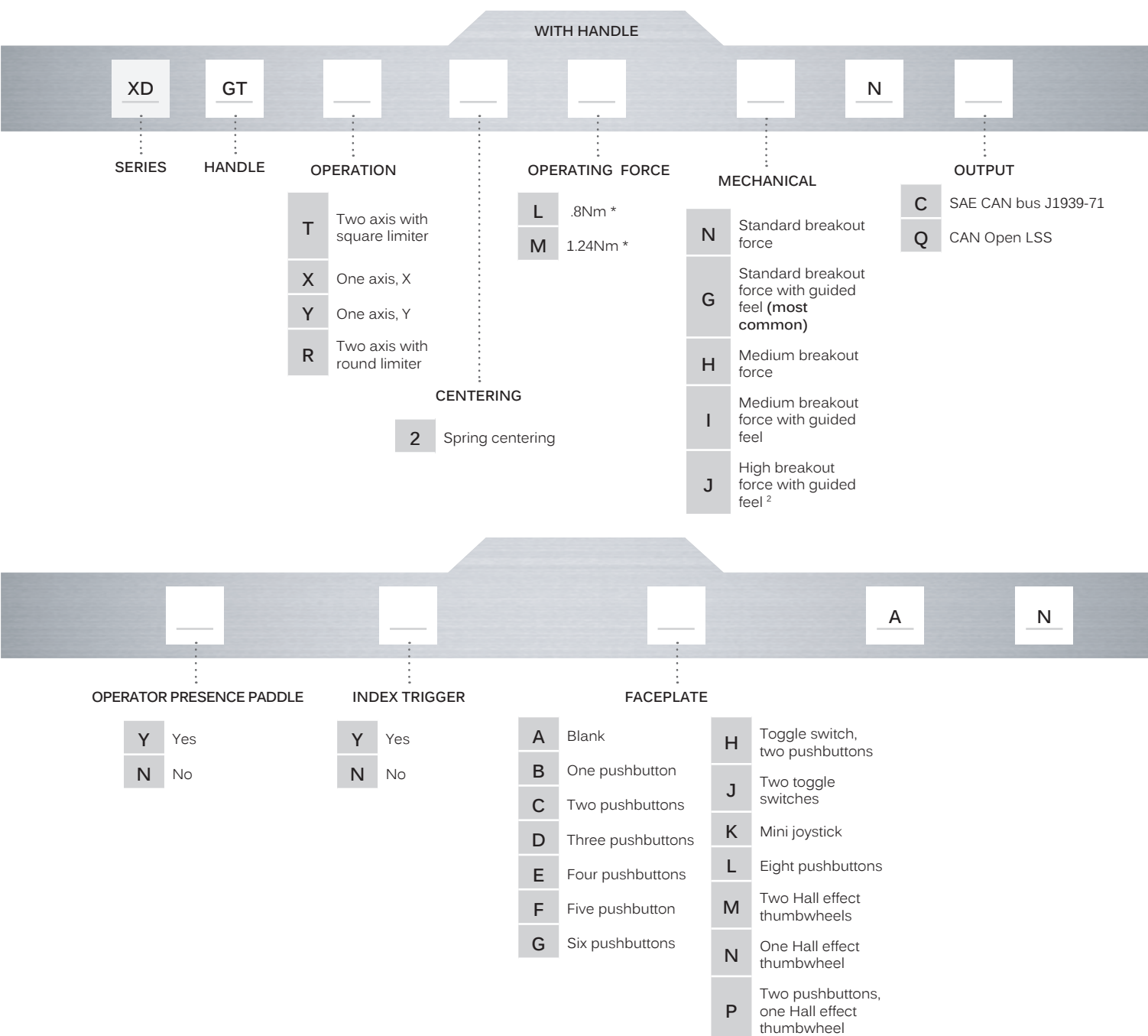
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APEN



BUILD YOUR PART NUMBER



Notes:

The Guided feel option aids the joystick lever into the cardinal direction
Guided feel option is recommended for «Operating force Option M»

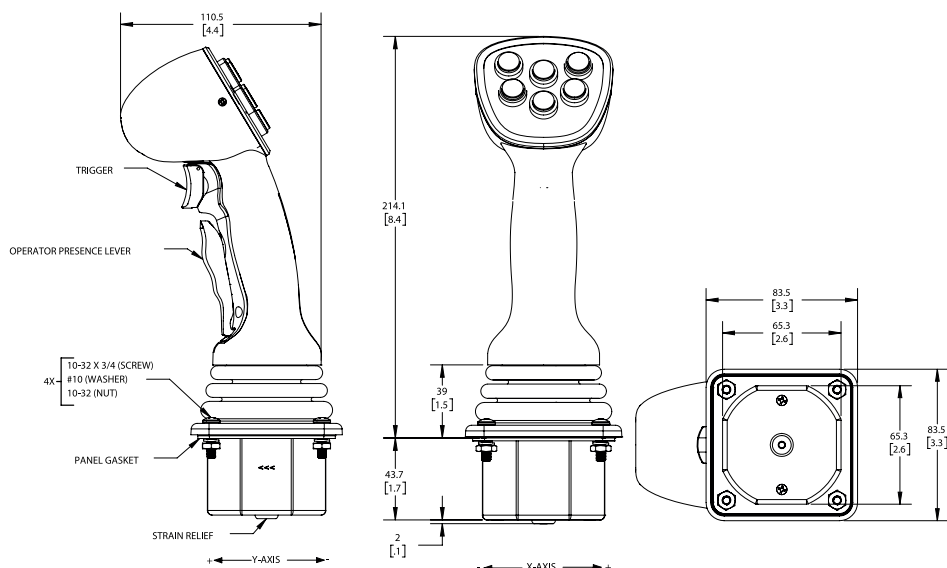
¹ Measured at $\pm 10^\circ$ (50% travel) from center (without guided feel.)

² High breakout force can only come with round limiter plate.

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DIMENSIONS



COMPONENT DESCRIPTIONS



- **MT series:** Sealed toggle switch
- MOM-OFF-MOM



- **IM series:** Sealed momentary pushbutton
- Snap action
- Red



- **TS series :** Miniature Hall effect joystick
- Two axis, proportional output
- Castle actuator



- **HR series:** Hall effect thumbwheel
- One axis, proportional output
- Black wheel

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FACEPLATE OPTIONS



A



B



C



D



E



F



G



H



J



K



L



M



N



P



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BUILD YOUR PART NUMBER

| SERIES | HANDLE | OPERATION | CENTERING | OPERATING FORCE | MECHANICAL | OUTPUT | BACK PLATE PUSHBUTTON | BACKPLATE ROCKER SWITCH | UPPER FACEPLATE CONFIGURATION | FACEPLATE ROLLERS | SEALING |
|--------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------|
| XD | RT | <div>T</div> Two axis with square limiter <div>X</div> One axis, X <div>Y</div> One axis, Y <div>R</div> Two axis with round limiter | <div>2</div> Spring centering | <div>L</div> .8 Nm ¹ <div>M</div> 1.24 Nm ¹ (most common) | <div>N</div> Standard breakout force <div>G</div> Standard breakout force with guided feel (most common) <div>H</div> Medium breakout force <div>I</div> Medium breakout force with guided feel <div>J</div> High breakout force with guided feel ² | <div>C</div> SAE CAN bus J1939-71 <div>Q</div> CAN Open LSS | <div>N</div> None <div>A</div> One momentary pushbutton - black <div>B</div> One momentary pushbutton - red | <div>N</div> None <div>B</div> mom-off-mom <div>C</div> on-off-on <div>H</div> HR roller - spring return to center ³ | <div>R00</div> Zero pushbutton / two rollers <div>R10</div> One upper pushbutton / two rollers <div>R01</div> One lower pushbutton / two rollers <div>R03</div> Two lower pushbuttons / two rollers <div>R30</div> Two upper pushbuttons / two rollers <div>R70</div> Three upper pushbuttons / two rollers <div>R07</div> Three lower pushbuttons / two rollers <div>R71</div> Three upper/ one lower pushbutton / two rollers <div>R55</div> Two upper / two lower pushbuttons / two rollers <div>R75</div> Three upper/ two lower pushbuttons / two rollers <div>R77</div> Six pushbuttons / two rollers <div>CB7</div> Five pushbutton / one 4-way NV / two rollers | <div>S</div> Single signal <div>R</div> Redundant signals | <div>N</div> Not specified. Inside cabin only <div>A</div> IP67 above panel sealing |

Notes:

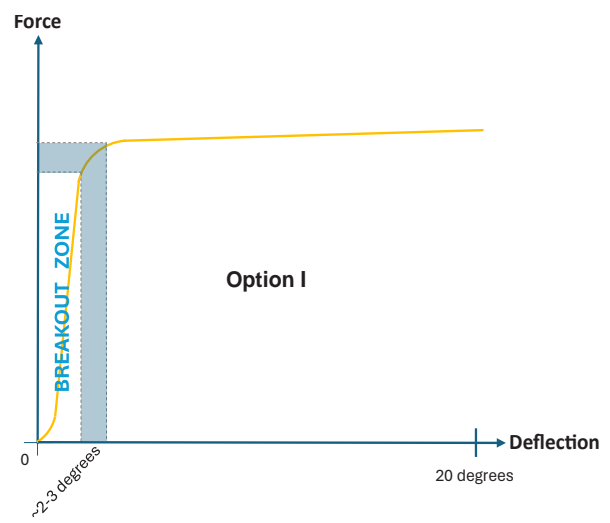
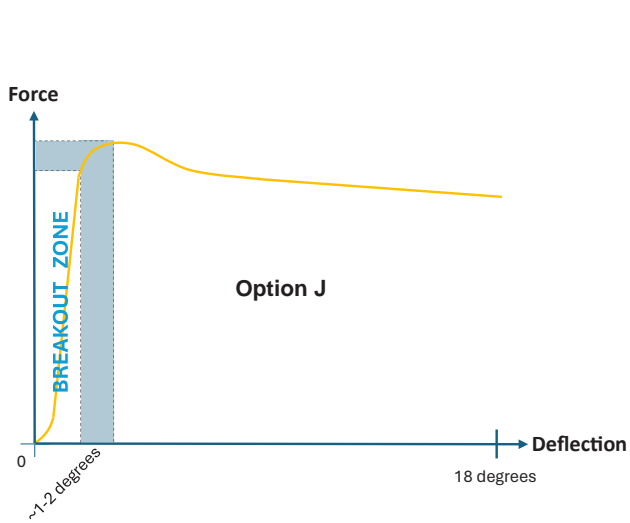
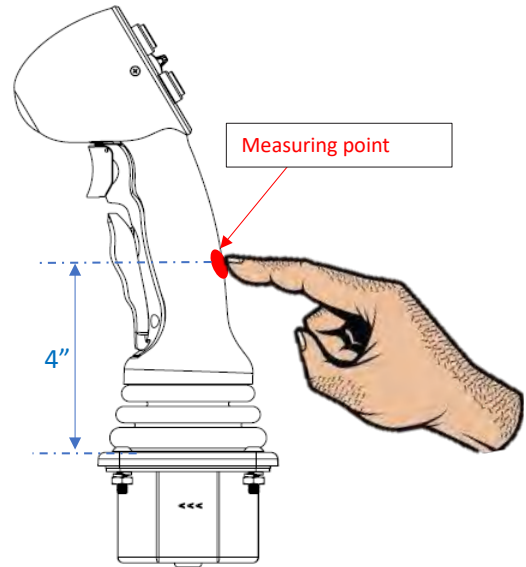
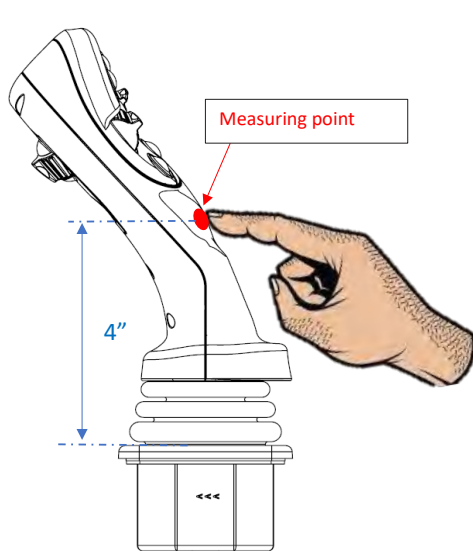
The Guided feel option aids the joystick lever into the cardinal direction
Guided feel option is recommended for «Operating force Option M»

¹ Measured at ±10° (50% travel) from center (without guided feel.)

² High breakout force can only come with round limiter plate.

³ Joystick cannot be IP67 with HR roller on the black plate

ACTUATION FORCE

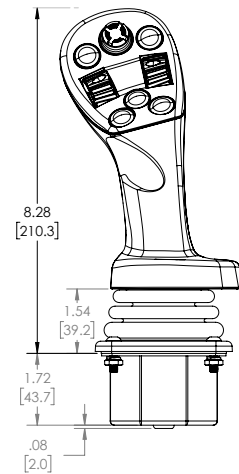
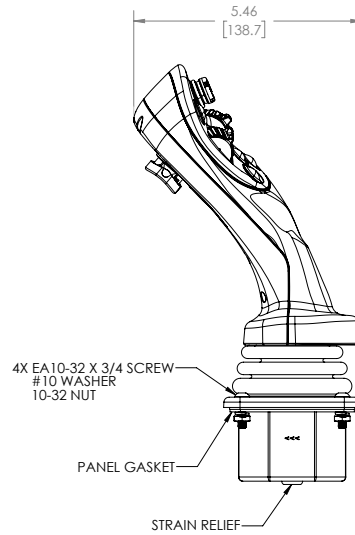


| MEASUREMENT ON CARDINAL DIRECTION (in lbf) | | | | |
|-------------------------------------------------|------------------|-------------------|-------------------|--------------------|
| BREAKOUT | 5% of deflection | 50% of deflection | 75% of deflection | 100% of deflection |
| OPTION | | | | |
| "I" (medium breakout force + guided feel) | 0.8±0.3 | 1.2±0.2 | 1.3±0.2 | 1.32±0.15 |
| "J" (high breakout force + guided feel) | 1±0.3 | 1.75±0.2 | 1.65±0.2 | 1.55±0.15 |

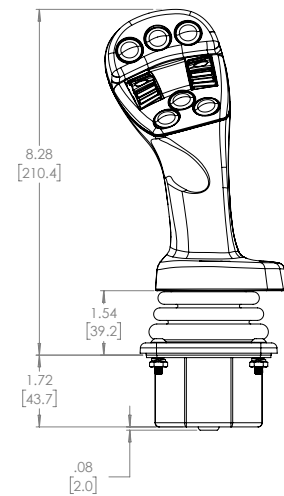
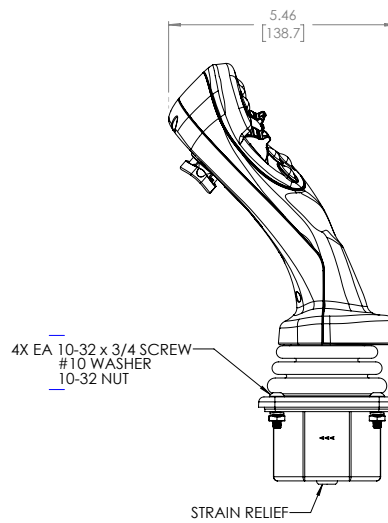
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CONTOURED FACEPLATE



RAISED FACEPLATE



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COMPONENT DESCRIPTIONS

FACEPLATE



- **IX series:** Sealed momentary pushbutton
 - Protective elastomer boot
 - IP67 panel sealed
 - Black



- **HR series:** Hall effect thumbwheel
 - One axis, proportional control
 - Single or redundant outputs
 - Optional IP67 panel sealing
 - Black



- **NV series :** 4 way navigation switch
 - Tactical momentary actuation
 - IP67 panel sealed

BACKPLATE



- **IS series:** Sealed momentary pushbutton
 - Tactile feedback
 - IP67 panel sealed
 - Black



- **HR series:** Hall effect thumbwheel
 - One axis, proportional control
 - Single output
 - Black



- **FNR series:** Three position rocker switches
 - MOM-OFF-MOM actuation
 - IP69K panel sealed
 - ON-ON-ON latch position



BACKPLATE OPTIONS



N no pushbutton
N no rocker switch



N no pushbutton
B mom-off-mom rocker switch



A black pushbutton
N no rocker switch



A black pushbutton
B mom-off-mom rocker switch

A black pushbutton
H roller spring return to center

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RAISED FACEPLATE OPTIONS



R00



R10



R01



R03



R30



R70



R07



R71



R55



R75



R77



CONTOURED FACEPLATE OPTION



CB7



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